WHAT WE CLAIM IS:

1. An electrophoresis apparatus comprising:

an anode and a cathode, the cathode spaced from the anode so as to define a distance along a longitudinal axis, the anode and cathode further defining an electric field having a direction substantially along the longitudinal axis;

an anode compartment, the anode disposed therein, a cathode compartment, the cathode disposed therein, each of the anode compartment and the cathode compartment being configured to hold at least one electrolyte, at least one of the anode compartment and the cathode compartment being configured to hold at least a portion of a sample, and each of the anode compartment and the cathode compartment including:

means for addition or removal of a solution;

a first compartment dimension, a second compartment dimension, and a third compartment dimension, the first compartment dimension being substantially orthogonal to the direction of the electric field, the second compartment dimension being substantially orthogonal to the direction of the electric field and the first compartment dimension, a ratio of the first compartment dimension and the second compartment dimension defining an aspect ratio of the compartment, and the third compartment dimension being substantially parallel to the direction of the electric field and substantially orthogonal to the first and second compartment dimensions; and

an ion-permeable barrier positioned between the anode compartment and the cathode compartment, the ion-permeable barrier being configured to prevent convective mixing therebetween, wherein

at least a portion of at least one of the anode and cathode compartments is made of an electrically insulating material having a thermal conductivity greater than about 1 W/mK and a specific heat greater than about 100 J/kgK and the aspect ratio of at least one of the anode compartment and the cathode compartment is less than one.

2. The electrophoresis apparatus of claim 1, further comprising sealing means disposed between the anode compartment and the cathode compartment.

3. The electrophoresis apparatus of claim 2, wherein the sealing means is adapted to contain the ion-permeable barrier and provide access of ions to the ion-permeable barrier.

4. The electrophoresis apparatus of claim 3, wherein the sealing means is made of a water insoluble polymer, the polymer being natural or synthetic.

5. The electrophoresis apparatus of claim 4, wherein the water insoluble polymer is selected from the group consisting of polyethylene, polypropylene, polyisobutylene, polyalkylenes, polyfluorocarbons, poly(dimethylsiloxane), poly(dialkylsiloxane), poly(alkylarylsiloxane), poly(diarylsiloxane), poly(ether ether ketones) or a combination thereof.

6. The electrophoresis apparatus of claim 2, further comprising housing means for containing the anode and cathode compartments.

7. The electrophoresis apparatus of claim 6, wherein at least a portion of the housing means is made of a material having a thermal conductivity greater than about 1 W/mK and a specific heat greater than about 100 J/kgK.

8. The electrophoresis apparatus of claim 7, wherein the material of the at least portion of the housing means is selected from the group consisting of alumina, aluminum nitride, zirconia, zirconium nitride, boron nitride, silicon nitride, silicon carbide, ceramics, fused silica, quartz, glass or any combination thereof.

9. The electrophoresis apparatus of claim 1, wherein the electrically insulating material of the at least one part of the anode or cathode compartment is selected from the group consisting of alumina, aluminum nitride, zirconia, zirconium nitride, boron nitride, silicon nitride, silicon carbide, ceramics, fused silica, quartz, glass or any combination thereof.

10. The electrophoresis apparatus of claim 1, wherein the aspect ratio of at least one of the anode compartment and the cathode compartment is less than about 1/2.

11. The electrophoresis apparatus of claim 10, wherein the aspect ratio of at least one of the anode compartment and the cathode compartment is less than about 1/5.

12. The electrophoresis apparatus of claim 11, wherein the aspect ratio of at least one of the anode compartment and the cathode compartment is less than about 1/10.

13. The electrophoresis apparatus of claim 12, wherein the aspect ratio of at least one of the anode compartment and the cathode compartment is less than about 1/20.

14. The electrophoresis apparatus of claim 1, wherein the ion-permeable barrier is essentially free of weekly acidic functional groups or weakly basic functional groups or anionic functional groups or cationic functional groups.

15. The electrophoresis apparatus of claim 1, wherein the ion-permeable barrier is an isoelectric barrier.

16. An electrophoresis apparatus comprising:

an anode and a cathode, the cathode spaced from the anode so as to define a distance along a longitudinal axis, the anode and cathode further defining an electric field having a direction substantially along the longitudinal axis;

an anode compartment, the anode disposed therein;

a cathode compartment, the cathode disposed therein;

at least one separation compartment positioned between the anode and cathode compartments, each of the anode compartment, cathode compartment and at least one separation compartment being configured to hold at least one electrolyte, at least one of the anode compartment, cathode compartment and at least one separation compartment being configured to hold at least a portion of a sample, and each of the anode compartment, cathode compartment and at least one separation compartment including:

means for an addition or removal of a solution;

a first compartment dimension, a second compartment dimension, and a third compartment dimension, the first compartment dimension being substantially orthogonal to the direction of the electric field, the second compartment dimension being substantially orthogonal to the direction of the electric field and the first compartment dimension, a ratio of the first compartment dimension and the second compartment dimension defining an aspect ratio of the compartment, and the third compartment dimension being substantially parallel to the direction of the electric field and substantially orthogonal to the first and second compartment dimensions; and

an ion-permeable barrier positioned between each of the anode compartment, the at least one separation compartment and the cathode compartment, the ion-permeable barrier being configured to prevent convective mixing therebetween, wherein

at least a portion of at least one of the anode compartment, the cathode compartment and the at least one separation compartment is made of an electrically insulating material having a thermal conductivity greater than about 1 W/mK and a specific heat greater than about 100 J/kgK and the aspect ratio of at least one of the anode compartment, the cathode compartment and the at least one separation compartment is less than one.

17. The electrophoresis apparatus of claim 16, further comprising sealing means disposed between the anode compartment, the cathode compartment and the at least one separation compartment.

18. The electrophoresis apparatus of claim 17, wherein the sealing means is adapted to contain the ion-permeable barrier and provide access of ions to the ion-permeable barrier.

19. The electrophoresis apparatus of claim 17, wherein the sealing means is made of a water insoluble polymer, the polymer being natural or synthetic.

20. The electrophoresis apparatus of claim 19, wherein the water insoluble polymer is selected from the group consisting of polyethylene, polypropylene, polyisobutylene, polyalkylenes, polyfluorocarbons, poly(dimethylsiloxane), poly(dialkylsiloxane), poly(alkylarylsiloxane), poly(diarylsiloxane), poly(ether ether ketones) or a combination thereof.

21. The electrophoresis apparatus of claim 16, further comprising housing means for containing the anode compartment, the cathode compartment and the at least one separation compartment.

22. The electrophoresis apparatus of claim 21, wherein at least a portion of the housing means is made of a material having a thermal conductivity greater than about 1 W/mK and a specific heat greater than about 100 J/kgK.

23. The electrophoresis apparatus of claim 22, wherein the material of the at least portion of the housing means is selected from the group consisting of alumina, aluminum nitride,

zirconia, zirconium nitride, boron nitride, silicon nitride, silicon carbide, ceramics, fused silica, quartz, glass or any combination thereof.

24. The electrophoresis apparatus of claim 16, wherein the electrically insulating material of the anode compartment, the cathode compartment and the at least one separation compartment is selected from the group consisting of alumina, aluminum nitride, zirconia, zirconium nitride, boron nitride, silicon nitride, silicon carbide, ceramics, fused silica, quartz, glass or any combination thereof.

25. The electrophoresis apparatus of claim 16, wherein at least one of the ion-permeable barriers is essentially free of weekly acidic functional groups or weakly basic functional groups or anionic functional groups or cationic functional groups.

26. The electrophoresis apparatus of claim 16, wherein at least one of the ion-permeable barriers is an isoelectric barrier.

27. The electrophoresis apparatus of claim 16, wherein the first dimension of the at least one separation compartment is less than about 5 millimeters.

28. The electrophoresis apparatus of claim 27, wherein the first dimension of the at least one separation compartment is less than about 3 millimeters.

29. The electrophoresis apparatus of claim 28, wherein the first dimension of the at least one separation compartment is less than about 2 millimeters.

30. The electrophoresis apparatus of claim 29, wherein the first dimension of the at least one separation compartment is less than about 1 millimeter.

31. The electrophoresis apparatus of claim 16, wherein the at least one separation compartment includes a first separation compartment and at least a second separation compartment, the first dimension of the first separation compartment being different than the first dimension of at least one of the anode compartment, the cathode compartment and the at least one second separation compartment.

32. The electrophoresis apparatus of claim 16, wherein the aspect ratio of the at least one separation compartment is less than about 1/2.

33. The electrophoresis apparatus of claim 32, wherein the aspect ratio of the at least one separation compartment is less than about 1/5.

34. The electrophoresis apparatus of claim 33, wherein the aspect ratio of the at least one separation compartment is less than about 1/10.

35. The electrophoresis apparatus of claim 34, wherein the aspect ratio of the at least one separation compartment is less than about 1/20.

36. The electrophoresis apparatus of claim 16, wherein the third dimension of the at least one separation compartment is less than about 1/2 of the distance between the anode and cathode.

37. The electrophoresis apparatus of claim 36, wherein the third dimension of the at least one separation compartment is less than about 1/3 of the distance between the anode and cathode.

38. The electrophoresis apparatus of claim 16, wherein the aspect ratio of at least one of the anode compartment, the at least one separation compartment and the cathode compartment is less than about 1/2.

39. The electrophoresis apparatus of claim 38, wherein the aspect ratio of at least one of the anode compartment, the at least one separation compartment and the cathode compartment is less than about 1/5.

40. The electrophoresis apparatus of claim 39, wherein the aspect ratio of at least one of the anode compartment, the at least one separation compartment and the cathode compartment is less than about 1/10.

41. The electrophoresis apparatus of claim 40, wherein the aspect ratio of at least one of the anode compartment, the at least one separation compartment and the cathode compartment is less than about 1/20.

42. The electrophoresis apparatus of claim 16, wherein the apparatus includes at least two separation compartments.

43. The electrophoresis apparatus of claim 42, wherein the apparatus includes at least three separation compartments.

44. The electrophoresis apparatus of claim 43, wherein the apparatus includes at least five separation compartments.

45. The electrophoresis apparatus of claim 44, wherein the apparatus includes at least ten separation compartments.

46. The electrophoresis apparatus of claim 45, wherein the apparatus includes at least twenty separation compartments.

47. The electrophoresis apparatus of claim 46, wherein the apparatus includes at least fifty separation compartments.

48. The electrophoresis apparatus of claim 16, wherein the third dimension of the anode compartment, the at least one separation compartment and the cathode compartment are the same.

49. The electrophoresis apparatus of claim 16, wherein at least two members of the group comprising the anode compartment, the at least one separation compartments and the cathode compartment have different third dimensions.

50. An electrophoresis apparatus comprising:

an anode compartment, a cathode compartment and at least one separation compartment therebetween, an anode in the anode compartment, a cathode in the cathode compartment, the anode and cathode defining an electric field therebetween, the electric field defining a direction from the anode to the cathode;

each compartment being configured to hold at least an electrolyte, at least one of the compartments being configured to hold at least a portion of a sample, each compartment having a first dimension substantially orthogonal to the direction of the electric field, a second dimension substantially orthogonal to the direction of the electric field and the first dimension, and a third dimension substantially parallel to the direction of the electric field, a ratio of the first and second dimensions of each compartment defining an aspect ratio for each compartment;

an ion-permeable barrier positioned between adjacent compartments so as to restrict convective mixing between the adjacent compartments;

wherein at least a portion of at least one of the compartments is made of a material having heat transfer properties including at least one of a thermal conductivity greater than about 1 W/mK and a specific heat greater than about 100 J/kgK and wherein further at least one of the aspect ratios is less than one.

51. An electrophoresis apparatus comprising:

an anode compartment, a cathode compartment and a plurality of separation compartments therebetween, an anode in the anode compartment, a cathode in the cathode compartment, the anode and cathode defining an electrode distance therebetween, the anode and cathode defining an electric field therebetween, the electric field defining a direction from the anode to the cathode;

the anode compartment being configured to hold an acidic solution, the cathode compartment being configured to hold a basic solution, at least one of the plurality of separation compartments being configured to hold at least a portion of a sample, each compartment having a first dimension substantially orthogonal to the direction of the electric field, a second dimension substantially orthogonal to the direction of the electric field and the first dimension, and a third dimension substantially parallel to the direction of the electric field, a ratio of the first and second dimensions of each compartment defining an aspect ratio for each compartment, each compartment having means for an addition or removal of a solution;

the anode compartment connected to the plurality of separation compartments through an isoelectric ion-permeable barrier restricting convective mixing between the connected compartments;

the cathode compartment connected to the plurality of separation compartment through an isoelectric ion-permeable barrier restricting convective mixing between the connected compartments;

each of the plurality of separation compartments being connected to each adjacent separation compartment through an ion-permeable barrier restricting convective mixing between the connected separation compartments, wherein

each of the plurality of separation compartments being made of alumina having a thermal conductivity greater than about 20 W/mK and a specific heat greater than about 200 J/kgK, an aspect ratio less than one fifth, and having a third dimension less than one third of the electrode distance.

52. An electrophoresis apparatus according to claim 51, wherein the ion-permeable barrier between each adjacent separation compartment is an isoelectric barrier.

53. An electrophoresis apparatus according to claim 51, wherein at least one of the ion-permeable barriers between the adjacent separation compartments is an isoelectric barrier.

54. An electrophoresis apparatus according to claim 51, wherein the ion-permeable barrier between each adjacent separation compartment is essentially free of weakly acidic, weakly basic, anionic and cationic functional groups.

55. A method of altering a composition of a sample by electrophoresis, the method comprising

providing an electrophoretic apparatus according to claim 1;

selecting an ion-permeable barrier for use between the anode and cathode compartments;

providing an electrolyte to the anode compartment;

providing an electrolyte to the cathode compartment;

providing the sample to at least one of the compartments;

creating an electrophoretic direct current between the anode and the cathode by applying an electric potential between the anode and the cathode, and

causing a transfer of at least one part of at least one component of the sample across the ion-permeable barrier.

56. A method of altering a composition of a sample by electrophoresis, the method comprising

providing an electrophoretic apparatus according to claim 16;

selecting an ion-permeable barrier for use between the adjacent compartments;

providing the sample to at least one of the compartments;

providing at least one electrolyte to any of the compartments free of the sample;

creating an electrophoretic direct current between the anode and the cathode by applying an electric potential between the anode and the cathode, and

causing a transfer of at least one part of at least one component of the sample across an ion-permeable barrier.

57. An electrophoresis apparatus substantially as shown and described as in FIGS. 1A and 1B.

58. An electrophoresis apparatus substantially as shown and described as in FIGS. 2A and 2B.

59. An electrophoresis apparatus substantially as shown and described as in FIGS. 2A and 2B.